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Effect of simulation on critical thinking, satisfaction and self-confidence of nursing students during care of pneumonic child

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Abstract

Background: The lack of chances in clinical practice during student learning has made simulation a necessary part of nursing courses. The aim was to investigate the effect of simulation on critical thinking, satisfaction and self-confidence of nursing students during care of pneumonic child.

Subjects & Method: A quasi-experimental (non-equivalent control group design) was utilized. The study was conducted at Pediatric Nursing Lab in Faculty of Nursing, Assiut University. Simulation group consisted of 35 students who learned through using the simulation scenario besides traditional method. Control group consisted of 35 students who learned through using only the traditional method.

Tools: Three tools were used in this study; critical thinking questionnaire, self-confidence in learning scale and satisfaction in learning scale.

Results: Students in the simulation group had a significantly higher score of critical thinking, satisfaction and self-confidence compared to those in the control group (12 ± 1.6, 21.1 ± 1.5, 30.8 ± 2.5 Vs. 6.6 ± 2.2, 16.2 ± 4.3, 24.7 ± 4.4 respectively).

Conclusion: The present study concluded that using the simulation scenario improved students' critical thinking, increased their self-confidence and reach higher satisfaction with highly statistically significant differences were found between the simulation and control groups.

Recommendations: Simulation method should be used in other courses and staff should be trained in developing scenarios and applying them in their courses.

Keywords: Care of pneumonic child, critical thinking, nursing students, satisfaction, self-confidence, simulation

1. Introduction

Simulation is a new method of nursing education which is commonly used in educating nursing students. Current applications of simulation range from task trainers (basic skills such as drawing blood) to high-fidelity simulation (mannequins with physiologic measures). It seems as a vital part in nursing education which improve the confidence of students in all domains of learning as knowledge, affective and psychomotor skills (Walters Linda, 2014) [34].

Simulation is recognized as an essential part of nursing clinical education by nursing institute since it can provide a safe environment for students to learn the clinical practice. There has been an increasing utilization of high-fidelity simulation (HFS) in nursing education since the 1990s (California Board of Registered Nursing, 2015; Colorado Department of Regulatory Agencies Board of Nursing, 2015, Arthur *et al*., 2013 and Crytzer, 2011) [12, 4, 14]

"Simulation is a technique, not a technology, to replace or amplify real experiences with guided experiences, often immersive in nature, that evoke or replicate substantial aspects of the real world in a fully interactive fashion" (Cited by Bennett, 2015). In addition to the clinical experience, simulation helps students to practice in controlled educational areas. Before application in the real situations, students are allowed to perform a skill (Hicks *et al*., 2009) [17].

Many challenges facing the clinical experience of pediatric nursing students such as overcrowding pediatric units in the hospital and shortened training time (Bultas, 2011) [10]. Simulation provides students with experiencing a procedure several times before facing it in a real life with increased competency, decreased time and improved self-confidence. This experience enables students to handle patient care better which have a positive effect on patient's health (American Academy of Pediatrics & American Heart Association, 2006) [3].

Simulation can be practiced in various forms as it used to train practical skills or role play. Simulation has the advantage of bridging a knowledge-practice gap and decrease patient risk (Society for Simulation in Healthcare, 2015).

One of the main skills needed by nurses is critical thinking which leads to improve patient safety. Nurses who use critical thinking handle situations with open mindness and

use sound decision making (Benner *et al*., 2010 and Billings & Halstead, 2009) [6, 9].

Moreover, building self-confidence in students is a basic effort in nursing practice. Confidence help nurses to achieve patient trust. Patients who receive care from a nurse who has confidence in her abilities ensure having a safe and high-quality care (Billings & Halstead, 2009) [9]. While the use of human patient simulators is increasing, the body of knowledge supporting claims that simulators improve self-confidence and critical thinking skills is lacking (Campbell & Daley, 2009) [11].

1.2. Significance of the study
Human patient simulators are expensive to purchase and maintain. It is vital to ensure the validity of using simulation in nursing education hence; it cost a great time, money and effort. So, it is imperative for nurse educators to know whether the claims that simulators improve critical thinking and self-confidence are valid or not (Durham & Alden, 2008) [16].

The lack of chances in clinical practice during student learning has made simulation a necessary part of nursing courses. The National Council of State Boards of Nursing (NCSBN) and the National League of Nursing (NLN) (2005) [24] support simulation for evaluation of learning domains and to assess the six core quality & safety education for nurses (QSEN) competencies. One way to verify that nursing students are meeting the QSEN competencies in a nursing program is to evaluate formatively and summatively utilizing simulation methodology (Bensfield *et al*., 2012) [8].

1.3. Aim of the study
The aim of the study was to investigate the effect of simulation on critical thinking, satisfaction and self-confidence of nursing students during care of pneumonic child.

1.4. Hypothesis
Students in the simulation group demonstrate improved critical thinking and achieve greater feelings of satisfaction and self-confidence as compared to students who learned using only the traditional methods of learning.

2. Subjects and Method
2.1. Study Design
A quasi-experimental (non-equivalent control group design) was utilized.

2.2. Study Setting:
The study was conducted at Pediatric Nursing Department's Labs in Faculty of Nursing, Assiut University, Egypt. Faculty of Nursing in Assiut was organized and opened in 1982, as a governmental educational institution. It included eight nursing departments; pediatric, medical surgical, maternity and neonatal health, critical care, community health, psychiatric, administration, and gerontological. It grants a bachelor degree in nursing science for undergraduate students and master and doctorate degree in eight specialties including pediatric and premature nursing. Their nursing students study five years; four of them are academic study in the faculty buildings and labs or in

training in the university hospitals departments or units. While the fifth year contains a practical training into the hospitals with complete supervision from the faculty staff members. English is the language of teaching and learning for the students in the faculty.

2.3. Study Subjects
The study subjects consisted of two groups of undergraduate pediatric nursing students at third year in the second semester during the academic year 2015-2016. The study subjects were assigned into two groups:
1. **Simulation group** consisted of 35 students who learned through using the simulation scenario beside traditional method.
2. **Control group** consisted of 35 students who learned through using only the traditional method.
   The two groups received pre-post knowledge test to evaluate the critical thinking skills of the studied students.

2.4. Sampling technique
- The researchers selected group one and two in the study because they were fulfilled the study criteria as; they were giving care to a child diagnosed with pneumonia, on oxygen therapy and having respiratory distress. Also, they were receiving a theoretical lecture about nursing care of a child with respiratory system disorders. Their first two rotations were in the emergency and medical units.
- After choosing the groups, the researchers used the coin to select the study group.
- The study group was trained in applying nursing care to a child with previous criteria through using simulation scenario, videos, giving medications and applying physical examination of chest and lung in pediatric patients.

Exclusion criteria: The students who missed a portion of the study as the pretest, intervention, a portion of the rotations or lecture or posttest were excluded from the study.

2.5. Tools of data collection:
Three tools were used in this study.

2.5.1. Tool One: Critical thinking questionnaire: It was developed by the researchers after reviewing the recent literature and included three parts:
- **Part one:** Students' personal characteristics as; age, sex, and residence.
- **Part two:** It included previous and current clinical experiences in hospitals and clinical experiences prior to and/or during the pediatric nursing rotation related to nursing procedures and diagnosis.
- **Part three:** Questions to test critical thinking skills:
It consisted of a properly written 15-item multiple choice critical thinking questions adapted from Hockenberry & Wilson (2015) [18], Datta (2014) [15], and Nclex –RN Pediatric Nursing (2011) [25]. The questions were modified to be posed at the application level or higher related to caring of pediatric patients who had pneumonia and respiratory distress so that they were better able to measure

critical thinking. About 46.7% of these questions represented application skills. While evaluation and analysis skills were represented by 20 % for each and synthesis skills represented 13.3 % as shown in figure (1). The questions were reviewed by three assistant professors in pediatric and two in critical care nursing to ensure that the students able to apply knowledge and utilize multi-logical thinking, therefore measure critical thinking skills. Each correct item was given a score of one with a total score of 15. Higher scores indicated higher critical thinking.
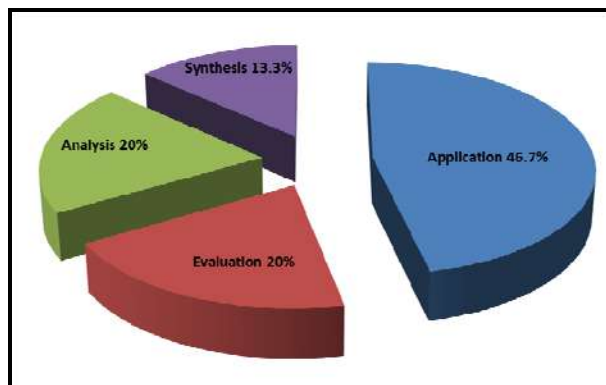

Fig 1: Critical thinking skills percentages

2.5.2. Tool two: Self-confidence in learning scale: It was developed by National League for Nursing (NLN) (Jeffries, 2005) [19]. It was used to measure nursing students' feelings of self-confidence. This instrument is an 8-item survey that uses a 5-point Likert scale and the scores ranged from 8 to 40. A student with a score of 30 or more indicates high self-confidence scores, 20 - 29 indicates moderate self-confidence and 19 and fewer score indicates low self-confidence. This survey is specific to student learning using simulators and simulation learning activities. This scale was reliable with reported Cronbach's alpha coefficient of internal consistency as 0.87.

2.5.3. Tool three: Satisfaction in learning scale: It was developed by Jeffries & Rizzolo (2006) [20]. It consisted of 5 items on a 5-point Likert scale. The score ranged from 5 to 25. Students, whose score 19 and more had high satisfaction in learning, score 13 – 18 indicated moderate satisfaction and a score of 12 and fewer indicated low satisfaction. This scale was reliable with reported Cronbach's alpha coefficient of internal consistency as 0.94.

2.6. Threats to Internal Validity
A threat of diffusion of treatment was controlled by ensuring that all students have the same learning experiences. Moreover, threat of maturation was limited by ensuring that all students have the same posttest which was started early in the course i.e. no time for maturation. For the two clinical groups, the educational interventions occurred after the second week of the hospital experience and the post-intervention evaluation occurred during the third week of the hospital experience. To control threat of selection the two groups were matchable with no statistically significant differences at the pre-test.

2.7. Method of Data Collection
1. An official permission to collect data was delivered from the Faculty Dean and Head of Pediatric Nursing Department, Assiut University.
2. Tool one was developed by the researchers based on reviewing of literature.
3. Ten percent of students were recruited for the pilot study to assess the clarity of the sheet and time needed to fulfill the sheet. No modifications were needed and the pilot sample was excluded from the study.
4. Internal consistency reliability for tool one was evaluated by using alpha – Cronbach test which was 0.85. It was tested for its content validity by five experts in the Pediatric and Critical Care Nursing field with a content validity index (CVI) was 0.9.
5. The pediatric nursing students' critical thinking was assessed by the researchers at pretest and posttest. The simulated scenario was applied during the hospital rotations for the simulation group. Both groups were reassessed after two weeks of hospital rotations using critical thinking questionnaire (tool one) and self-confidence in learning (tool two) and student satisfaction (tool three).
6. The design of the scenario is based on the Bay Area Simulation Collaborative (BASC) template from the California Simulation Alliance (CSA) and includes learning outcomes, scenario review, pre-scenario learner activities, case summary, the cast of actors, patient profile, environment, essential props and case flow (Waxman, 2010) [35].
7. The researcher used Erikson's psychosocial and Piaget's cognitive developmental theories for developing simulation-based pediatric nursing scenarios. Contents of scenarios were taken from Principles of Pediatric Nursing Textbook: Caring for Children by Ball *et al*. (2015) [5]. Scenario development for simulation enhances students' learning that improves utilization of critical thinking, utilizes developmental considerations, and perform nursing care of a child with pneumonia and had respiratory distress was integrated into the learning outcomes in the simulation-based scenario.

2.8. Ethical considerations
1. Ethical Committee of Nursing Faculty, Assiut University, Egypt approved the proposal before starting the research.
2. The students were all informed about the study and were advised that they are under no obligation to take part, and that choosing to take part or not didn't affect their education or assessment.
3. The researchers ensured that there was no harm to the students during application of the research. The study followed common ethical principles in clinical research.
4. All students who agreed to participate in the study signed a written consent, after explaining the nature and purpose of the study.
5. Confidentiality and anonymity were secured.
6. Privacy of study subjects was considered during collection of data.

2.9. Statistical analysis

Data entry was done using SPSS version 20.0 statistical software package. It was presented using descriptive statistics as mean and standard deviation, frequencies and percentages. Variables were compared using t-test and chi-square test. Statistical significance was considered at p-value <0.05.

3. Results

Table 1: Personal characteristics of studied students of both groups

Characteristics	Simulation group N=35		Control group N=35		X^2	P-value*
- Age/year (Mean ± SD)	21.26 ± 0.56		21.34 ± 0.59		t-test (0.58)	0.6
- Sex:						
• Male	7	20.0	9	25.7	0.78	0.4
• Female	28	80.0	26	74.3		
- Residence:						
• Urban	20	57.1	25	71.4	1.56	0.2
• Rural	15	42.9	10	28.6		

* P-value = <0.05

Table (1): Illustrates the personal characteristics of studied students of both groups. It was clear from the table that the mean age of students in both groups was 21.26 ± 0.56 and 21.34 ± 0.59 years old for the simulation and control groups respectively. It was also noticed that the majority of the students in both groups were females (80%) in the simulation group and 71.4% in the control group. Regarding the students' residence, it was found that more than half (57.1%) of the simulation group were from urban settings compared to 71.4 % of those in the control group. There were no statistically significant differences between both groups regarding all items before starting the intervention.

Table 2: Percentage distribution of students regarding previous & current clinical experiences of both groups

Clinical experiences	Previous clinical experiences N=35		X^2	P-value	Current clinical experiences N=35		X^2	P-value*
	Simulation group %	Control group %			Simulation group %	Control group %		
I- Working at private hospital prior to/during pediatric nursing rotation.								
• Yes	14.3	11.4	0.41	0.5	17.1	8.6	1.15	0.3
• No	85.7	88.6			82.9	91.4		
II- Clinical experiences prior to/during pediatric nursing rotation related to nursing procedures.								
Intravenous infusion	71.4	68.6	4.87	0.2	65.7	77.1	1.35	0.7
Nasal Cannula	8.6	20.0			54.3	48.6		
Face Mask	20.0	20.0			42.9	48.6		
No clinical experiences	17.1	20.0			0.0	2.9		
III- Clinical experiences prior to/during pediatric nursing rotation related to these diagnoses.								
Pneumonia	5.7	5.7	1.30	0.7	94.3	82.9	5.73	0.1
Severe acute bronchial asthma	25.7	20.0			5.7	22.9		
Respiratory distress	25.7	20.0			5.7	14.3		
No clinical experiences	68.6	74.3			0.0	2.9		

* P-value = <0.05

Table (2): Shows the percentage distribution of students regarding previous & current clinical experiences of both groups. It was found that the majority of students in both groups didn't work at a private hospital prior to/during pediatric nursing rotation. Also, it was revealed from the table that the majority of previous and current clinical experience of the students (71.4 vs. 68.6) and (65.7 vs. 77.1) respectively were in the care of patients with intravenous infusion. Students from both groups had no previous clinical experiences as regards respiratory diseases. However, the majority of the students had current clinical experiences regarding pneumonia. There was no statistically significant difference between the simulation and control group as regards previous or current clinical experiences.

Table 3: Mean score of the students regarding critical thinking skills, satisfaction and self-confidence in both groups

Mean and SD	Total score	Simulation group N=35				Control group N=35				Post simulation and control group	
		Pre	Post	t-test	p-value*	Pre	Post	t-test	p-value*	t-test	p-value*
• Critical thinking	15	5.8 ± 2.1	12.0±1.6	13.96	0.000	6.0 ± 1.8	6.6±2.2	1.25	0.21	11.74	0.000
• Satisfaction	25	Simulation group (Post only)				Control group (Post only)					
		21.1 ± 1.5				16.2 ± 4.3				4.90	0.000
• Self-confidence	40	30.8 ± 2.5				24.7 ± 4.4				6.10	0.000

* P-value = <0.05

Table (3): Represents the distribution of the students regarding mean score of critical thinking skills, satisfaction, and self-confidence in both groups. Students in the simulation group had a significantly higher score of critical thinking, satisfaction and self-confidence compared to those in the control group (12 ± 1.6, 21.1 ± 1.5, 30.8 ± 2.5 Vs. 6.6 ± 2.2, 16.2 ± 4.3, 24.7 ± 4.4, respectively).

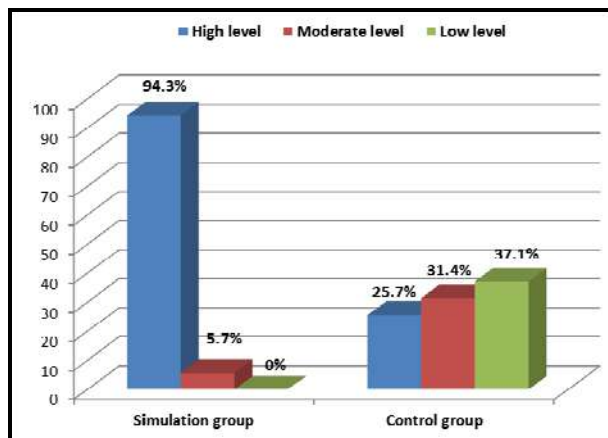of satisfaction (0.0%) compared to 37.1% of the students in the control group.

Fig 2: Percentage distribution of students according to level of satisfaction in both groups (post only)

Figure (2): Shows the percentage distribution of students according to the level of satisfaction in both groups (post only). It was noticed that the majority of students in the simulation group had a higher level of satisfaction (94.3%) compared to 25.7% of those in the control group. On the other hand, no one in the simulation group had a lower level
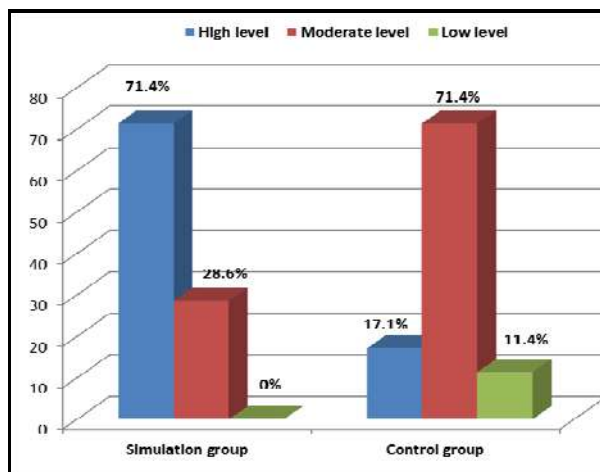

Fig 3: Percentage distribution of students according to the level of self-confidence in both groups (post only)

Figure (3): Illustrates the percentage distribution of students according to the level of self-confidence in both groups (post only). It was found that the students in the simulation group had a higher level of self-confidence (71.4%) compared to 17.1% of those in the control group. While no one in the simulation group had a lower level of self-confidence (0.0%) compared to 11.4% of the students in the control group.

Table 4: Percentage distribution of the studied students who answered the critical thinking questions correctly

Critical thinking skills	Total number of questions	Question percent	Simulation group N=35		X^2	P-value*	Control group N=35		X^2	P-value*	Post simulation and control group	
			Pre	Post			Pre	Post			X^2	P-value*
• Application skills	7	46.7	42.9	81.2	3.06	0.002	40.4	44.9	0.10	0.5	2.90	0.003
• Analysis skills	3	20.0	36.2	74.3	2.97	0.003	42.9	33.3	0.58	0.6	3.20	0.001
• Synthesis skills	2	13.3	27.1	82.9	4.45	0.000	44.3	47.1	0.0	1.0	2.89	0.004
• Evaluation skills	3	20.0	38.1	81.0	3.41	0.001	35.2	50.5	1.05	0.3	2.44	0.01

* P-value = <0.05

Table (4): Reveals the percentage distribution of the critical thinking skills among the studied students who answered the questions correctly. The percentage of correct answer questions was significantly higher among students in the simulation group after the intervention compared to those in the control group regarding all levels of knowledge (p= 0.003, 0.001, 0.004, 0.01) respectively.

Discussion
Learning strategy using simulation may help meet the need for creative methods to educate nursing students. Simulations are planned to expand or replace real-life circumstances, providing students chance to reflect their idea into clinical problems and make decisions, without the risk of harming actual patients (Thomas & Mackey, 2012 and Richards et al., 2010) [33, 28].
The current study aimed to investigate the effect of simulation on critical thinking, satisfaction and self-

confidence of nursing students during care of pneumonic child. This study found a significant improvement in the critical thinking score of simulation group compared to the control group and between the post and pretest among simulation group.
The current study was in line with numerous previous findings as Saied (2017) [29] who found that the posttest knowledge scores in the simulation group differ significantly than that of the pretest as regards care of children. The same finding was also reported by Kim and Kim (2015) [21] and Tawalbeh and Tubaishat (2013) [32].
In addition; Abusaad et al. (2015) [1] indicated a significant effect of simulation on pediatric students' knowledge about neonatal resuscitation in the form of increasing mean score of knowledge immediately post intervention and three month later in simulated group than traditional group. Moreover, a dissertation by Soucy et al. (2011) [31] revealed improvement in students' critical thinking skills using

simulators. However, Ravert (2008) [27] found no significant effect of simulation on critical thinking.

This may be interpreted as using simulation scenario as a teaching method improved brainstorming skills and touch cognitive, psychomotor and affective skills that were difficult to be forgotten and strengthen their memory. So, the simulation has an effective role in transforming knowledge into action and bridging the know-do gap.

Furthermore, simulation scenario incorporated a good environment for all elements of the learning process as knowledge and skills. It simulated a real situation as the hospital. Also, it links theoretical knowledge with practical skills and clinical experiences that they studied in their curriculum. Moreover, they could summarize a lot of information in a simulated real situation.

The current study noticed that the majority of students in the simulation group had a higher level of satisfaction and self-confidence than those in the control group. These results were in agreement with several studies done by Agha et al. (2015) [2], Mould et al. (2011) [23], and Hicks et al. (2009) [17].

Megel et al. (2012) [22] revealed that high fidelity simulation could decrease the pediatric nursing students' anxiety and raise their confidence before the first application of child's assessment and care in the hospital. Also, Hicks et al. (2009) [17] indicated that when the students are capable to practice a procedure before the application on a live patient, this will have a positive effect on the students which increase their self-confidence and satisfaction.

Moreover, this was concurrent with a study by Omer Tagwa (2016) who found that the students were satisfied with their learning and that the clinical simulation session improved up their self-confidence. Students indicated high satisfaction because the methods used in the simulation were effective and give them clear ideas of what is expected from them. Also, students indicated that learning by simulation enables them to improve and retain knowledge e.g. can recognize signs and symptoms of diseases and can perform necessary tasks in a clinical practice. These knowledge acquisition abilities improve their self-confidence.

This could be explained that care of children is a very critical and sensitive. And there was no enough chance in the hospital for the students to apply nursing care of emergency situations as; a child with respiratory distress or having oxygen therapy. But during simulation intervention, there is an excellent opportunity for the students to try learning for more than one time. This good chance gives them high self-confidence and greater satisfaction when giving care actually in the hospital.

This may be attributed that when in the study group felt a real benefit from the simulation and reach a competence level, this had a positive reflection to increase their satisfaction with simulation and self-confidence. These encourage the students when encounter a real patient situation responds quickly and appropriately and gave better patient outcomes.

5. Conclusion
The present study concluded that using the simulation scenario improved students' critical thinking, increased their self-confidence and reach higher satisfaction with highly statistically significant differences were found between the simulation and control groups.

6. Recommendations
The study recommended that
1. Applying simulation scenarios as a teaching method to the pediatric nursing course on other or all parts of the course, also, in different courses of nursing program.
2. Using the simulation scenarios in the nursing labs to simulate the real situations before applying it in the clinical area.
3. Equip the nursing labs with human simulators to apply high fidelity simulations HFS (refers to the use of a computer-controlled full size manikin to demonstrate realistic clinical manifestations and clinical scenarios).
4. Conducting another study to assess the effect of simulation on the objective structured clinical exam (OSCE).
5. Another study should be conducted to assess effect of simulation after long period of time.

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